AMS-02 ECAL TIM
RECORD OF DISCUSSIONS (derived from agenda)
@ INFN Pisa June 17-19, 2002

IHEP has the responsibility for the AMS-02 ECAL Full Scale Prototype (FSP) structural design, analyses, and testing. IHEP has responsibility for the manufacturing of the Flight ECAL Structure and assembly of the pancake into the structure.

Mechanics:

1) status of the Full Scale Prototype (FSP) ECAL
   a. Modifications to the ECAL Bracket Design – None are anticipated at this time.
   b. Modifications to the support structure design – IHEP will send the current FSP drawings, NASTRAN FE Model Bulk Data File (BDF), and stress report to Franck Cadoux/LAPP/Annecy, Chris Tutt/LMSO, & Trent Martin/LMSO by July 8, 2002. Franck will provide suggestions for the IHEP model and boundary and loading conditions so that it is consistent with the FE model he has developed.
   c. Resolution of the shear pin material discrepancy – IHEP will procure the proper material and fabricate new shear pins. They will be installed in the FSP and retained with glue for the Space Qualification Tests (SQTs). For the Flight ECAL, they will be retained with safety wire attached to adjacent bolts with drilled heads. Other methods to provide a positive retention of the shear pins is acceptable.

2) Equipping of FSP for the next test beam period – per agreements between INFN/Pisa, IHEP, & LAPP/Annecy.

3) Strategy for weight saving on the Flight ECAL
   a. Who will do the FE modeling – There will be TWO FE models of the ECAL:
      1. The FSP model which will reflect the configuration in the SQTs. This model must also include all non-structural mass (PMTs, electronics, cables, connectors, thermal radiators, etc.) that are connected to the ECAL that will affect the loads/stresses applied to its structure. This is the responsibility of IHEP.
      2. The Flight ECAL model which will include all the above as well as any other changes to save weight or that affects its configuration. This is the responsibility of LAPP.

   Mr. Li/BISEE will do all ECAL FSP FE modeling for IHEP with consulting by Mr. Ao Lin. Franck Cadoux/LAPP will do all Flight ECAL FE modeling for LAPP & INFN/Pisa. If a Chinese engineer experienced in FE modeling is not available, then another arrangement will be made to assist F. Cadoux/LAPP.
   No personnel associated with CALT will be involved in the design or analyses. The only involvement CALT will have is the manufacturing under the direction of IHEP.
   Franck has submitted three possible ways to save weight on the Flight ECAL lateral panels. The thinner spring foam will also be considered in the calculations for weight savings.
   b. What FE modeling program will be used? Mr. Li/BISEE will use NASTRAN. Franck Cadoux/LAPP/Annecy will use Systus and Samcef. The final model submittals to LMSO will be by LAPP in NASTRAN.

c. How will the model be verified by LMSO? The FSP NASTRAN FE model results will be compared to the FSP drawings and the FSP SQT results. The Flight ECAL NASTRAN FE model will be compared to the final Flight ECAL drawings, the FSP NASTRAN FE model, and results of the sine sweep tests on the Flight ECAL. INFN/LAPP will do mission success vibration tests on the FSP with "live" PMTs. They may also have some live PMTs on the FSP during the SQTs. If possible, mass simulators should be added to the FSP for the non-structural mass. If it is not reasonable to do so, then the load factors may be increased accordingly to account for the lack of mass simulators.
d. Who will modify the Flight ECAL fabrication drawings? IHEP will modify the Flight ECAL drawings based on recommendations by LAPP and INFN. Note: Identify <u>all</u> fasteners; including locking inserts.
e. In what language? The drawing modifications recommended by LAPP and INFN will be in English. IHEP will produce the drawings in English and then translate them to Chinese for manufacturing by CALT.
All other documentation (assembly procedures, structural analyses reports, etc.) must also be produced in English.
f. Who is coordinating this activity in China? IHEP

~~4) planning for the final project of the flying module~~
(This the same as #6 below.)

5) Planning for Prototype Space qualification tests in China
   a. Who is coordinating this activity in China? IHEP
   b. Will all the tests be done at BISEE? Yes
   c. Vibration and Sine Burst test levels – Random vibration levels are unchanged. LMSO will perform a new analyses with the latest models (including the latest FSP ECAL FE model) and a lower uncertainty factor for the Sine Burst load factors. The effects of the redesign of the USS-02 and Vacuum Case for the increased weight carrying capability (14,000 to 14,809 lbs.) will also be included. These results will be ready no later than the SQT TIM in Beijing. The new Sine Burst load factors will be within the capabilities of the 16,000 kg force vibration table at BISEE.
   d. The fixture to simulate the USS-02 will be fabricated by BISEE using drawings supplied by LMSO. INFN can also produce the USS-02 simulator if required. It will be adapted to a <u>new</u> Head Expander developed by BISEE. The TOTAL mass (FSP ECAL + USS-02 Simulator + Head Expander) X the final Sine Burst load factor must not exceed the capability (16,000 kg force) of the vibration table at BISEE. IHEP will write a letter to Franco Cervelli/INFN/Pisa stating that BISEE will develop the USS-02 simulator and the new Head Expander. These two pieces will be delivered to INFN/LAPP as soon as the SQTs are completed. The requirement for the Head Expander first natural frequency will be defined by LMSO within 2 weeks after the FSP ECAL FE model is delivered.
   Note that the head expander should be designed to handle the heaviest possible test configuration (in the X and Y axes) up to the maximum capacity of the vibration table (16,000 kg force) with a Safety Factor of 3.

6) Planning for the construction of the Flight ECAL
   a. Who is coordinating this activity in China? IHEP

b. Assembly procedures – who does it? IHEP will develop the assembly procedures for the pancake integration into the support structure. IHEP will send copies of these assembly procedures to K. Bollweg/LMSO by July 15, 2002. LAPP and INFN will develop the assembly procedures for the installation of the PMTs, electronics, cables, connectors, thermal radiators, etc.
c. Quality and Configuration Control for the Flight ECAL – IHEP, BISEE and LAPP under direction of INFN.
d. Use of proper fasteners - type and length – will be verified by IHEP, BISEE and LAPP
e. Proper documentation – will be verified by IHEP, BISEE and LAPP under direction of INFN. Will be sent to K. Bollweg/LMSO when the Flight ECAL is completed.

f. Review of Logistics – who is currently responsible for what, when, and where (review of agreement dated May 8, 2002) – modified per attachments
g. Avoidance of shipping or Customs processing damage – Each institute that ships hardware is responsible for verification that it leaves their country in the intended condition. Any Customs personnel inspections will be under the watchful eye of the institute responsible for shipping. When the inspection is complete, the institute personnel will apply quality tags/stickers/seals to ensure the shipping crate is not opened again until it is inspected by the receiving institute.

GENERAL NOTES:

Current estimated ECAL weight: ~660 kg with the last three layers of lead removed and the addition of HV cables and connectors.
Current ECAL control weight: 638 kg. Therefore, the ECAL is currently ~22 kg over weight. The FSP ECAL FE model should indicate a total of ~650 kg since some of the cable and connector weight will be carried by the USS-02 and the electronics crates. (F. Cadoux/LAPP will supply the non-structural weight distribution to IHEP by June 25, 2002.)

SQT TIM in Beijing – Tentatively September 23 & 24, 2002. IHEP will verify.

Last ECAL PMT accessibility would be no later than post thermal vacuum tests/before shipping to KSC.

IHEP will investigate uneven compression of the spring foam as presented by F. Cadoux/LAPP.

Proposed SQT Sequence (To be reviewed by BISEE):
Set up hardware for X-axis tests. Perform X-axis Sine Sweep, X-axis Random Vibration, X-axis Sine Sweep, X-axis Sine Burst, X-axis Sine Sweep.
Reconfigure for Y-axis tests. Perform Y-axis Sine Sweep, Y-axis Random Vibration, Y-axis Sine Sweep, Y-axis Sine Burst, Y-axis Sine Sweep.
Reconfigure for Z-axis tests. Perform Z-axis Sine Sweep, Z-axis Random Vibration, Z-axis Sine Sweep, Z-axis Sine Burst, Z-axis Sine Sweep.

Attendees:

Franco Cervelli, INFN/Pisa
Jean-Pierre Vialle, LAPP/Annecy
Franck Cadoux, LAPP/Annecy
Honglin Zhuang, IHEP
Yusheng Lu, IHEP
Ken Bollweg, LMSO
Chris Tutt, LMSO